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Coastal Inlets as Strategic Habitat for Shorebirds in the Southeastern United States

by Brian R. Harrington

PURPOSE: The purpose of this technical note is to bring together information from the International Shorebird Surveys (ISS) to demonstrate shorebirds' keystone-use of inlet habitats on marine coasts as compared to other coastal habitats in the southeastern United States including North Carolina, South Carolina, Georgia and Florida. Many inlets in the U.S. are affected by activities regulated by the U.S. Army Corps of Engineers (Corps). The goal of this Technical Note is to raise awareness of the importance of inlet habitats to coastal wildlife, including several species of shorebirds in the highest categories of conservation concern. This summary is largely based on an evaluation and presentations made at a workshop coordinated by American Bird Conservancy (ABC) working with the Corps of Engineers (Corps), held February 1-4, 2005 at Jekyll Island, Georgia (Guilfoyle et al. 2006; http://el.erdc.usace.army.mil/dots/coastalbirds.html). The ERDC and ABC hosted a series of three workshops dealing with coastal Corps activities and bird conservation. The Jekyll Island workshop covered the South Atlantic Coast, essentially from the Virginia-North Carolina border to south Florida. Subsequent workshops covered the North Atlantic and the Gulf Coasts. Workshop objectives were to expand capabilities of the Corps to contribute to various bird conservation plans, to make the bird conservation community aware of opportunities that exist through working with the Corps, to address and hopefully reduce some areas of conflict, and to improve interagency and organization cooperation for bird conservation in these coastal regions. This report, which provides guidance on how to create and manage dredged-material islands as early-successional bird habitat, supports the objectives and was funded from a research work unit under the Corps of Engineers Dredging Operations and Environmental Research (DOER) program titled, "Reducing conflicts between coastal engineering projects and bird habitat needs." (http://el.erdc.usace.army.mil/dots/coastalbirds.html).

Figure 1. Red Knots (*Calidris canutus*) and other birds at a coastal inlet in Georgia.

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BACKGROUND: The Corps is responsible for managing and maintaining navigable coastal and inland waterways of the United States. Activities associated with the maintenance of waterways and shorelines in the coastal region include dredging, dredged material disposal operations, and beach nourishment. Coastal engineering projects can potentially create, enhance, degrade, or destroy foraging and nesting habitat at important coastal bird breeding, stopover, or wintering sites. Operations near sites important to birds should be carefully designed so as to reduce negative impacts as well as to protect and conserve existing foraging habitats or beach and upland nesting areas.

This technical note is part of a peer-reviewed series of focused publications that address two different areas where the Corps could better contribute to bird conservation: 1) enhancing the practice of dredged material disposal for the creation and maintenance of bird nesting islands, shorebird and waterbird foraging habitat, and wetland restoration projects that provide high quality bird habitat; and 2) designing and implementing coastal engineering projects that provide better nesting, foraging, and roosting habitats for shoreline-dependent birds. The Corps is working closely with American Bird Conservancy to improve communication with the bird conservation community to assist in the conservation of birds while simultaneously carrying out its various missions (Guilfoyle et al. 2006, 2007).

Sand spits, jetties, islets, tidal flats, shoals and sandbars often are associated with inlets, and are important habitats to a variety of coastal birdlife, including pelicans, cormorants, gulls, terns, and "shorebirds." Shorebirds in the United States are roughly 50 species of sandpipers, plovers, and their allies. Some shorebirds breed on southeastern U.S. coasts and may spend migration or winter periods there as well, whereas others visit southeast coasts principally during nonbreeding seasons (migration and/or winter). Breeding areas for most species are in Arctic regions of Canada and Alaska. However, four species breed in coastal habitats of the Southeast, including Piping plover (*Charadrius melodius*), Snowy plover (*C. alexandrinus*), Wilson's plover (*C. wilsonius*), and American Oystercatchers (*Haematopus palliatus*) (Hayman et al. 1986). Most of the shorebird species that occur in the southeastern United States visit during nonbreeding seasons, and coastal habitats along the Atlantic and Gulf Coasts of the Southeast are important wintering and migratory habitat for a majority of the shorebirds that breed in the United States (Withers 2002). This note focuses on the nonbreeding seasons, illustrating the importance of inlet habitats to many species of migratory shorebirds.

Inlet habitats in the southeastern United States frequently are affected by waterway and beach nourishment projects that are regulated and/or operated by the Corps. Associated Corps activities include channel dredging for maintenance and improvement of navigable waterways for boat traffic, and/or removing sand from intertidal or supratidal sandbars for use in beach nourishment projects. There is a potential for conflict between these important Corps activities and wildlife habitat needs. The main purpose of this publication is to illustrate the importance of inlet locations to shorebirds, and to describe those species that potentially would be most affected by Corps actions around inlets. The goal is to show that disproportionately high numbers of seven species of shorebirds use inlet habitats, and that six out of seven species are of high conservation priority, according to wildlife experts (Brown et al. 2001). Further research should be done to identify whether or not there are important conflicts through loss of key habitats, and if so, how to ameliorate for them.

METHODS: Ideally, numbers of shorebirds using inlet habitats would be determined in an unbiased survey of inlets and all other coastal habitats on a substantial portion of the U.S. coast. With the exception of one species, the American Oystercatcher (Brown et al. 2005), no such evaluation exists. However, a large database of shorebird counts – The International Shorebird Surveys (ISS) – is available. In the ISS, shorebirds have been counted following a standardized protocol at hundreds of U.S. coastal locations. The ISS is focused on migration seasons (Spring = 1 April through 10 June, and Fall = 10 July-31 October), asking volunteer cooperators to count all shorebirds at a specific site selected by the cooperator once every 10 days. For more information about the ISS, visit links through www.manomet.org or see Harrington et al. (1989).

Species names used in this note are those approved by the American Ornithologists' Union. For binomial names see http://www.aou.org/checklist/index.php3#char .

For this publication, all coastal ISS sites in the southeastern United States were evaluated (NC, SC, GA, and FL, N = 361 sites), characterizing each as being either 'inlet habitat' (N = 98) or 'not inlet' habitat (N = 234). Inlets were defined as locations where water bodies such as rivers, lagoons, or narrow mouths of bays were connected to ocean waters along a barrier beach shoreline; all other coastal sites were 'not inlet.'

For each location, the highest count for each of 22 shorebird species (listed in Table 1) that are common on southeast U.S. coasts were identified. Maxima were used for simplicity, keeping in mind that there are close correlative relationships between maximum, mean, and median counts in the ISS database.[1]

Variance among ISS counts is high both within and among sites. This is because (a) some sites have thousands of shorebirds, others have only dozens; (b) migration periods differ among species (e.g., in fall some species migrate in July, others not until September or October; (c) some sites are counted only in one season (spring or fall), others in both; (d) some sites are visited during only one year, others for multiple years; and (e) migration itself is characterized by brief spells of high counts and long spells of (generally) lower or zero counts. Due to the large and non-homogeneous variance of bird numbers counted at ISS sites, a non-parametric Wilcoxon Scores test was used (NPAR1WAY (SAS Institute, Inc. 2004)) to compare the occurrence of each of the 22 species at inlet versus non-inlet coastal habitats. Relative abundance of species at the 98 inlet sites was compared to the 234 non-inlet sites. Statistically significant differences were based on normal approximation values (two-tail) where the probability was less than 0.05.

RESULTS: Seven of the 22 shorebird species were found more often than expected ($P < 0.05$) at inlet locations versus non-inlet locations (Table 1). Six of these seven "inlet species" are either of High Conservation Concern or Imperiled according to the United States Conservation Plan (Table 1). Only one of the 22 shorebird species, the Sanderling (*Calidris alba*), was found significantly more often at non-inlet than inlet locations (Table 1).

[1] Unpublished data, Brian Harrington, Senior Scientist, Shorebird Research and Conservation Program, Manomet Center for Conservation Sciences, Manomet, MA.

Table 1. Relative occurrence of 22 shorebird species at 'inlet' and 'non-inlet' coastal locations in the southeastern United States. Species shown in bold were present in significantly higher numbers at inlets than at other coastal sites with the exception of one (italicized) whose numbers were higher at non-inlet locations.

Species	% of inlet sites[1] with species present	% non-inlet sites[1] with spp. present	Inlets					Not inlets					P^3	Conservation Priority[4]
			Max[2]	Med[2]	Mean	Min[2]	IQR[2]	Max	Med	Mean	Min	IQR[2]		
American Avocet	9	6	84	0.0	1.0	0	0	1050	0.0	7.2	0	0	0.3480	3
Am. Oystercatcher	38	31	250	0.0	13.2	0	2	350	0.0	6.3	0	4	0.1127	4
Black-bellied Plover	**87**	**79**	**500**	**10.0**	**46.6**	**0**	**40**	**3000**	**5.5**	**45.0**	**0**	**26**	**0.0030**	**3**
Dunlin	65	60	4700	10.5	248.5	0	150	5500	7.0	156.2	0	100	0.2000	3
Greater Yellowlegs	31	29	35	0.0	1.5	0	1	250	0.0	4.4	0	1	0.9214	3
Long-billed Dowitcher	10	9	20	0.0	0.7	0	0	325	0.0	4.7	0	0	0.8919	2
Least Sandpiper	39	34	1050	0.0	25.5	0	10	4580	0.0	43.7	0	4	0.3934	3
Lesser Yellowlegs	19	24	150	0.0	2.9	0	0	1200	0.0	16.8	0	0	0.2820	3
Marbled Godwit	27	23	120	0.0	6.2	0	1	363	0.0	9.6	0	0	0.5562	4
Piping Plover	**44**	**24**	**110**	**0.0**	**6.5**	**0**	**5**	**235**	**0.0**	**4.0**	**0**	**0**	**0.0004**	**5**
Red Knot	**42**	**32**	**10000**	**0.0**	**373.8**	**0**	**118**	**6500**	**0.0**	**126.2**	**0**	**7**	**0.0364**	**5**
Ruddy Turnstone	**79**	**65**	**3736**	**10.5**	**64.9**	**0**	**28**	**800**	**4.0**	**26.8**	**0**	**25**	**0.0091**	**4**
Sanderling	***92***	***71***	***1500***	***40.0***	***137.9***	***0***	***132***	***6150***	***12.0***	***181.3***	***0***	***68***	***<.0001***	***4***
Short-billed Dowitcher	55	47	6000	7.0	186.0	0	69	1370	0.0	66.9	0	50	0.1241	4
Semipalmated Plover	60	58	1653	6.0	68.3	0	59	1000	3.0	45.7	0	25	0.1961	2
Semipalmated Sandpiper	30	22	660	0.0	28.8	0	5	1500	0.0	29.5	0	0	0.1469	3
Snowy Plover	**26**	**15**	**105**	**0.0**	**2.7**	**0**	**1**	**70**	**0.0**	**2.0**	**0**	**0**	**0.0383**	**5**
Spotted Sandpiper	26	28	30	0.0	1.3	0	1	120	0.0	2.3	0	1	0.7921	2
Western Sandpiper	**62**	**45**	**9430**	**5.0**	**211.8**	**0**	**63**	**3000**	**0.0**	**104.3**	**0**	**17**	**0.0041**	**4**
Whimbrel	26	22	125	0.0	5.2	0	1	150	0.0	3.9	0	0	0.4827	4
Willet	87	76	1003	7.5	56.5	0	44	2550	6.0	70.9	0	49	0.5204	3
Wilson's Plover	**44**	**26**	**185**	**0.0**	**13.7**	**0**	**10**	**200**	**0.0**	**6.6**	**0**	**1**	**0.0004**	**4**

[1] Based on maximum counts made at 98 inlets and 234 'non-inlets.
[2] Max = maximum count, Med = median count, Min = minimum count, IQR = interquartile range.
[3] Normal approximation values based on two-tail Wilcoxon Scores, NPAR1WAY, SAS Institute, 1989.
[4] 5 = Highly Imperiled, 4 = Species of High Concern, 3 = Moderate Concern, 2 = Low Concern (U.S. Shorebird Conservation Plan).

DISCUSSION: Shorebird activities in coastal habitats are substantially influenced by tide levels; during lower tides shorebirds tend to be foraging, while at higher tides they tend to be resting (Ruiz et al. 1989). For many kinds of shorebirds the supra-tidal sandy habitats of inlets provide important areas for resting (Ruiz et al. 1989), especially at higher tides when intertidal habitats are inundated. At lower tides, some of these inlet-loving species prefer foraging on invertebrates characteristic of sandy, intertidal habitats such as sandbars or barrier beaches, which often are present at inlets. Other species may travel short distances from inlet resting sites to intertidal habitats landward of the inlets where intertidal habitats typically are muddier.[1] In this publication, shorebird numbers were simply assessed at inlets and other coastal habitats without regard to whether the birds were foraging or resting.

Implications: The results reported here suggest that the Corps should minimize any potential impacts to inlet habitats during inlet-related projects in southeastern U.S. coastal locations because of the potential negative impacts on inlet-dependent birdlife. This study suggests that the occurrence and numbers of shorebirds using coastal habitats of the Southeast is skewed towards use of inlet habitats versus other coastal habitats, and that this is especially true in the case of seven species that rank high in national conservation priorities (Table 1). One of these seven species, the Piping Plover, is endangered in its Great Lakes population (*C. melodus circum-cinctus*) (Goossen et al. 2002), the bulk of which spend the winter nonbreeding season on the U.S. southeastern coast (Goossen et al. 2002, Noel 2006). Another of the seven species, the Red Knot (*Calidris canutus*), was listed as a Candidate Species under the U.S. Endangered Species Act in 2006. Although alteration of bird habitats by the Corps during inlet-related projects was not a focus of this investigation, the potential effects (e.g., as illustrated in Figures 2 and 3) should be better understood. It should also be noted that 14 of the 22 species in this analysis showed no difference between inlet and non-inlet areas, suggesting that inlets are used equally by these species and therefore, may be very important habitats for them as well.

Sampling: Sites included in the ISS are selected for coverage by the volunteer cooperators doing the counting, and conceivably there could be a bias towards coverage of sites having higher versus lower numbers of shorebirds. However, it is difficult to imagine any bias that would cause inlets having higher numbers and/or occurrence of shorebirds to be selected relatively more often than non-inlet locations having higher numbers and/or occurrence of shorebirds. In short, the evidence indicates that inlet habitats are unusually important to at least seven species of coastal shorebirds in the Southeast. Based on personal observations by the author 'inlet-o-philia' is assuredly prevalent in other types of southeastern U.S. coastal birds, including various species of gulls, terns, cormorants, and Brown Pelicans.

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Figure 2. An inlet showing intertidal ebb and flow sandbars, extensive development of sandspits, sandflats attached to barrier islands, and muddier tidal flats on the sheltered (inland) side of the barrier beach. Photo by Walker Golder, National Audubon Society.

Figure 3. Stabilized inlet, where jetties impede sand flow parallel to the barrier beach, reducing potential for formation of ebb and flow sandbars and sandspits. Photo by Walker Golder, National Audubon Society.

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Useful web sites

http://el.erdc.usace.army.mil/training.cfm?Topic=Workshop&List=05feb-dots
PowerPoint presentations from the joint Corps/American Bird Conservancy February 2005 meeting on Jekyll Island entitled, "The First Regional Workshop on Dredging, Beach Nourishment, and Birds on the South Atlantic Coast - and - A Symposium on the Wintering Ecology and Conservation of Piping Plovers"

http://www.abcbirds.org
The American Bird Conservancy

http://www.manomet.org/
Manomet Center for Conservation Sciences (home of the International Shorebird Surveys).